Advanced Polymer

In the mid-1980s, Langley Research Center invented a new type of polymer, a plastic that has utility as a matrix resin to bind together the fibers that reinforce composite materials. The compound is a thermoplastic polyimide that is thermally stable and resists solvents.

The Langley development, a polyimide sulfone, combines the desirable properties of two major classes of polymers: polyimides and polysulfones. The latter are easy to process but are very soluble and cannot be used in applications where solvents—such as aircraft fluids—are present, because they might damage components fabricated from such materials.

However, composites and other products made from polyimide sulfone *can* be used in the presence of solvents and corrosive fluids; they offer the advantages of light weight, low cost and ease of fabrication for a broad range of industrial uses. Applications, in addition to matrix resins for fiber reinforced composites, include molding resins, adhesives and foam.

Noting the broad commercial potential of the polyimide sulfone, High Technology Services, Inc. (HTS), Troy, New York obtained a NASA license to adapt the compound to specific applications. HTS had already made the material available as a solution (polyamic acid), but the company saw that considerable processing flexibility could be obtained if the material were available in both polyamic acid and fine powder forms.

In 1990, HTS was awarded Phase I/II NASA Small Business Innovation Research contracts to pursue development of polyimide sulfone in fine powder form. A successful development program led to production of polyimide sulfone in both acid and powder forms and introduction of the material to the commercial market for high temperature applications.

The principal use of the material among HTS customers is as a matrix resin for composites. HTS is also marketing the polyimide as a high temperature structural adhesive for aircraft structures and as a coating to provide protection from radiation and high temperature for electronic components. The company is also exploring the material's use in flame resistant foam for marine and aerospace applications; **below left** an engineer is torch-testing a sample of the material.

HTS was founded in 1983 by Milton L. Evans (pictured **below** in his laboratory), now president, a veteran of 20 years service with the General Electric Company in scientific, marketing and general management posts. In addition to the polyimide sulfone, the company has licenses for several other NASA patents and the HTS core product line is based on that technology. ●